




U.S. APPLICATION NO. if known, see 37 C.F.R. 1.5 <div style="font-size: 2em; font-weight: bold; margin-left: 100px;">10/089911</div>	INTERNATIONAL APPLICATION NO PCT/EP00/08547	<div style="text-align: right;">         1018 Rec'd PCT/PTO 04 APR 2002          ATTORNEY'S DOCKET NUMBER          22750/543       </div>
17. <input checked="" type="checkbox"/> The following fees are submitted.		CALCULATIONS   PTO USE ONLY
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Claims	Number Filed	Number Extra
Total Claims	16 - 20 =	0
Independent Claims	2 - 3 =	0
Multiple dependent claim(s) (if applicable)		+ \$280.00
<b>TOTAL OF ABOVE CALCULATIONS =</b>		\$ 890.00
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).		\$
<b>SUBTOTAL =</b>		\$ 890.00
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Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property		\$
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Kenyon & Kenyon One Broadway New York, New York 10004 <b>CUSTOMER NO. 26646</b>		<div style="text-align: center;">           SIGNATURE       </div> <div style="text-align: center;"> <u>Richard M. Rosati, Reg. No. 31,792</u>          NAME       </div> <div style="text-align: center;"> <u>04 April 2002</u>          DATE       </div>

[22750/543]

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant : Rudolf WAGNER et al.  
Serial No. : To Be Assigned  
Filed : Herewith  
For : **HEEL LINING FOR THE SHOE INDUSTRY**  
Art Unit : To Be Assigned  
Examiner : To Be Assigned

Box PCT  
Assistant Commissioner  
for Patents  
Washington, D.C. 20231  
Attn: DO/EO/US

**PRELIMINARY AMENDMENT AND  
37 C.F.R. § 1.125 SUBSTITUTE SPECIFICATION STATEMENT**

SIR:

Please, without prejudice, amend the above-identified application before examination, as set forth below.

**IN THE SPECIFICATION AND ABSTRACT:**

In accordance with 37 C.F.R. § 1.121(b)(3), a Substitute Specification (including the Abstract, but without claims) accompanies this response. It is respectfully requested that the Substitute Specification (including Abstract) be entered to replace the Specification of record.

**IN THE CLAIMS:**

On the first page of the claims, first line, change "What is claimed is:" to --WHAT IS CLAIMED IS:--

Please amend claims 1 to 16 as follows:

1. (Amended) A heel lining for the shoe industry, made up of a nonwoven fabric impregnated with a polymer, having a surface weight of 180 to 350 g/m<sup>2</sup>, and tear propagation resistance values greater than 15 N in both the lengthwise and the crosswise direction, wherein the nonwoven fabric is made up of melt-spun, multi-component endless filaments, aerodynamically stretched and directly laid up to form a nonwoven material, having a titer less than 2 dTex, and wherein the multi-component endless filaments, after preliminary bonding, are split and bonded up to at least 90 % to produce supermicro endless filaments having a titer less than 0.2 dTex.

2. (Amended) The heel lining according to claim 1, wherein the multi-component endless filament is a bi-component endless filament of two incompatible polymers, said two incompatible polymers including a polyester and a polyamide.

3. (Amended) The heel lining according to claim 2, wherein the polyester portion of the multi-component endless filament is higher than the polyamide portion.

4. (Amended) The heel lining according to claim 3, wherein the weight ratio of the polyester portion to the polyamide portion in the multi-component endless filament is 1.1:1 to 3:1.

5. (Amended) The heel lining according to claim 2, wherein the multi-component endless filaments have a cross-section with an orange-like multi-segment structure, wherein the segments alternately contain one of the two incompatible polymers, in each instance.

6. (Amended) The heel lining according to claim 1, wherein the nonwoven fabric made of the multi-component endless filaments is pre-calandered for the purpose of preliminary prebonding.

7. (Amended) The heel lining according to claim 2, wherein at least one of the incompatible polymers that forms the multi-component endless filament contains an

8. (Amended) The heel lining according to claim 1, wherein the multi-component endless filament is not crimped.

9. (Amended) The heel lining according to claim 1, wherein the nonwoven fabric is impregnated with 20 to 50 wt.-% of a polymer, with reference to the starting weight of the nonwoven fabric.

10. (Amended) The heel lining according to claim 1, wherein a high-quality nubuck-like surface is formed after polishing due to ends of the microfilament being exposed at the surface.

11. (Amended) The heel lining according to claim 1, wherein one of the two sides of the heel lining is provided with an application of hot-melt glue.

12. (Amended) A method for the production of a heel lining, the method comprising the steps of:

spinning multi-component endless filaments from a melt;  
aerodynamically stretching the multi-component endless filaments;  
directly laying up the multi-component endless filaments to form a nonwoven material;

performing a prebonding step by one of calendering or needle-punching;  
bonding the nonwoven fabric by high-pressure fluid jets;  
simultaneously splitting the nonwoven fabric into supermicro-filaments having a titer  
< 0.2 dTex; and  
impregnating the nonwoven fabric with a polymer.

13. (Amended) The method according to claim 12, wherein the steps of bonding and splitting the multi-component endless filaments includes the steps of alternately impacting the multi-component endless filaments from both sides with high-pressure water jets, several times.

14. (Amended) The method according to claim 13, wherein the steps of bonding and splitting the multi-component endless filament is performed on a unit with rotating screen drums.

15. (Amended) The method according to claim 12, wherein the step of impregnating the nonwoven fabric is performed with an aqueous polyurethane latex dispersion.

16. (Amended) The method according to claim 12, further comprising at least one of the steps of polishing and buffing.

#### **REMARKS**

This Preliminary Amendment amends without prejudice original claims 1-16 in the underlying PCT Application No. PCT/EP00/08547. The amendments conform the claims to U.S. Patent and Trademark Office rules, and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.121(b)(3), the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. § 1.121(b)(3)(iii) and § 1.125(b)(2), a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) is respectfully requested.

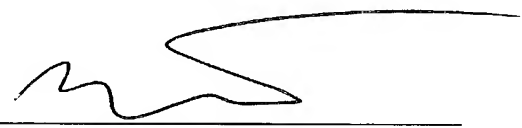
The underlying PCT Application No. PCT/EP00/08547 includes an International Search Report, mailed December 14, 2000. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report accompanies this Preliminary Amendment.

The underlying PCT application also includes an amended International Preliminary Examination Report, dated December 6, 2001.

Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,  
KENYON & KENYON

Dated: *April 4, 2002* By:

  
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Richard M. Rosati  
(Reg. No. 31,792)

**Version With Markings to Show Changes Made**

1. (Amended) A heel lining for the shoe industry, made up of a nonwoven fabric impregnated with a polymer, having a surface weight of 180 to 350 g/m<sup>2</sup>, and tear propagation resistance values greater than [ $>$ ] 15 N in both the lengthwise and the crosswise direction, wherein [where] the nonwoven fabric is [being] made up of melt-spun, multi-component endless filaments, aerodynamically stretched and directly laid up to form a nonwoven material, having a titer less than 2 dTex [ $< 2 \text{ dtex}$ ], and wherein the multi-component endless filaments, after preliminary bonding, are split and bonded up to at least 90 % to produce supermicro endless filaments having a titer less than 0.2 dTex [ $< 0.2 \text{ dtex}$ ].

2. (Amended) The heel lining according to claim [Claim] 1, wherein the multi-component endless filament is a bi-component endless filament of two incompatible polymers, said two incompatible polymers including [particularly] a polyester and a polyamide.

3. (Amended) The heel lining according to claim [Claim] 2, wherein the polyester portion [proportion] of the multi-component endless filament is higher than the polyamide portion [proportion].

4. (Amended) The heel lining according to claim [Claim] 3, wherein the weight ratio of the polyester portion [proportion] to the polyamide portion [proportion] in the multi-component endless filament is 1.1:1 to 3:1.



5. (Amended) The heel lining according to claim 2 [one of Claims 1 to 4], wherein the multi-component endless filaments have a cross-section with an orange-like multi-segment structure, wherein [where] the segments alternately contain [containing] one of the two incompatible polymers, in each instance.

6. (Amended) The heel lining according to claim 1 [one of Claims 1 to 5], wherein the nonwoven fabric made of the multi-component endless filaments is pre-calandered for the purpose of preliminary prebonding.

7. (Amended) The heel lining according to claim 2 [one of Claims 1 to 6], wherein at least one of the incompatible polymers that forms the multi-component endless filament contains an additive, selected from a group consisting of [such as] dyeing pigments, permanently acting anti-statics and/or additives that influence the hydrophilic properties, in amounts up to 15 wt.-%.

8. (Amended) The heel lining according to claim 1 [one of Claims 1 to 7], wherein the multi-component endless filament is not crimped.

9. (Amended) The heel lining according to claim 1 [one of Claims 1 to 8], wherein the nonwoven fabric is impregnated with 20 to 50 wt.-% of a polymer, with reference to the starting weight of the nonwoven fabric.

10. (Amended) The heel lining according to claim 1 [one of Claims 1 to 9], wherein a high-quality nubuck-like surface is formed after polishing due to ends of the [, brought about by the] microfilament [ends] being exposed at the surface.

11. (Amended) The heel lining according to claim 1 [one of Claims 1 to 10], wherein one of the two sides of the heel lining is provided with an application of hot-melt glue.

12. (Amended) A method for the production of a heel lining, the method comprising the steps of [according to one of Claims 1 to 11, characterized in that]:

spinning multi-component endless filaments [are spun] from a [the] melt; [,] aerodynamically stretching the multi-component endless filaments; [stretched, and]

directly laying [laid] up the multi-component endless filaments to form a nonwoven material;

[a] performing a prebonding step [takes place] by one of calendering or needle-punching;

bonding [and] the nonwoven fabric [is bonded] by high-pressure fluid jets [and, at the same time,];

simultaneously splitting the nonwoven fabric [split] into supermicro-filaments having a titer < 0.2 dTex [dtex,]; and

impregnating the nonwoven fabric [subsequently impregnation] with a polymer [takes place].

13. (Amended) The method [process] according to claim [Claim] 12, wherein the steps of bonding and splitting [of] the multi-component endless filaments includes the steps of [takes place in that the pre-bonded nonwoven fabric is] alternately impacting the multi-component endless filaments [impacted] from both sides with high-pressure water jets, several times.

16. (Amended) The method [process] according to claim 12 [one of Claims 12 to 15], further comprising at least one of the steps of [wherein subsequent treatment by] polishing and [or] buffing [is carried out].

## HEEL LINING FOR THE SHOE INDUSTRY

## Specification

The invention relates to a heel lining for the shoe industry, and to a method for the production of the same.

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In the shoe industry, particularly wear-resistant materials are used for lining the back part of a shoe, the so-called heel cap. These materials are supposed to absorb the forces that are exerted on the shoe by the foot, particularly during the flexing movement, in the longitudinal direction, for one thing, and for another, they must be able to withstand the friction forces that are caused in the shoe while walking, since the foot moves at least partially up and down within it. In order to prevent the foot from unintentionally slipping out of the shoe, a material similar to rough leather or suede is traditionally used as a heel lining, which prevents the foot from slipping out of the shoe by the effect of the friction between the lining and the foot or the lining and the wearer's sock or stocking.

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In addition to heel linings made from natural materials, synthetic materials are also used. These synthetic materials are needle-punched nonwoven fabrics that are produced using the dry method, by crimping, and made of polyester, viscose, polyamide, or polypropylene fibers, or of mixtures of these fibers. For this purpose, fiber layers with a surface weight of up to 800 g/m<sup>2</sup> are laid down and mechanically consolidated by intensive needle-punching. This process step alone is very time-consuming and therefore relatively cost-intensive. It is generally followed by shrinkage of the needle-punched nonwoven fabric by hot air or steam, resulting in compaction of the material as well as further consolidation with regard to

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adjustment of the density desired for the purpose of use. In order to achieve the necessary strength parameters such as tear resistance and tear propagation resistance of the needle-punched nonwoven fabric, the latter is impregnated with a latex binder dispersion that coagulates under the effect of heat, such as styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) and subsequently dried. The latex proportion is about 30 to 60 wt.-% of the weight of the impregnated nonwoven fabric. The material prepared in this way is split into two to four thinner layers. This splitting process was taken over for nonwoven fabrics from the leather industry, in order to increase the productivity of nonwoven fabric production. The split products can be ground in order to make the surface uniform, or in order to improve the optical finish. Subsequently, a hot-melt glue is applied to one of the two sides, in order to simplify further processing. A disadvantage of the synthetic heel linings used until now has been, in particular, the very different strength values in the lengthwise and the crosswise direction, the loss in strength which occurs by splitting the fiber bundles that are arranged vertically as a result of needle-punching, and the lack of uniformity of the individual layers, caused by the position of the layers relative to the needle entry and exit side.

The invention has set itself the task of indicating a heel lining for the shoe industry that demonstrates tear resistance and tear propagation resistance values  $> 15 \text{ N}$  in both the lengthwise and the crosswise direction, at surface weights of 180 to  $350 \text{ g/m}^2$ .

The invention has furthermore set itself the task of indicating a particularly suitable process for the production of such a heel lining.

This task is accomplished, according to the present invention, by a heel lining that is made up of a nonwoven fabric

impregnated with a polymer, with a surface weight of 180 to 350 g/m<sup>2</sup>, and tear propagation resistance values > 15 N in both the lengthwise and the crosswise direction, where the nonwoven fabric is made up of melt-spun, aerodynamically stretched multi-component endless filaments, with a titer < 2 dtex, immediately deposited to form a nonwoven layer, and the multi-component endless filaments, after preliminary consolidation, are split by at least 90% to produce supermicro endless filaments with a titer < 0.2 dtex, and consolidated. These heel linings demonstrate high tensile strength and friction wear resistance values at low surface weight.

Preferably, the heel lining is one in which the multi-component endless filament is a bicomponent endless filament of two incompatible polymers, particularly a polyester and a polyamide. As a result, the multi-component endless filament demonstrates good splittability and a very advantageous ratio of strength to surface weight.

Preferably, the heel lining is one in which the polyester portion of the multi-component endless filament is higher than the polyamide portion, particularly in the range of a weight ratio of the polyester portion to the polyamide portion of 1.1:3 to 3:1. As a result, the heel linings demonstrate a very textile feel and good resistance to aging.

A heel lining in which the multi-component endless filaments have a cross-section with an orange-like multi-segment structure is particularly preferred, where the segments alternately contain one of the two incompatible polymers.

Preferably, the heel lining is one in which the nonwoven fabric made of the multi-component endless filaments is pre-calandered for the purpose of preliminary consolidation. This causes the material to demonstrate very good uniformity in thickness.

Furthermore, a heel lining in which at least one of the incompatible polymers that forms the multi-component endless filament contains an additive, such as color pigments, permanently acting anti-statics and/or additives that influence the hydrophilic or hydrophobic properties, in amounts up to 15 wt.-%, is particularly preferred. In this way, the heel lining can be positively influenced with regard to its resistance to fading, its tendency to become electrostatically charged, the transport of perspiration, or the effect of accumulated moisture. Furthermore, the addition of color pigments into the spinning mass makes it possible to produce dark colors, resistant to friction wear.

Furthermore, a heel lining in which the multi-component endless filament is not crimped is particularly preferred, since this ensures the textile feel that results from the good splittability into supermicro endless filaments.

A heel lining in which the nonwoven fabric is impregnated with 20 to 50 wt.-% of a polymer, with reference to the starting weight of the nonwoven fabric, is particularly preferred according to the invention. At comparable degrees of impregnation, the heel lining demonstrates superior strength properties as compared with the known synthetic heel lining materials.

It is advantageous if the heel lining is one in which one of the two sides is provided with an application of hot-melt glue. Such a material is particularly well suited for further processing on automatic machines.

The process according to the present invention, for the production of the heel lining, includes the steps that multi-component endless filaments are spun from the melt, aerodynamically stretched, and immediately deposited to form a nonwoven layer, that preliminary consolidation takes place by needle-punching or calendering, and that the nonwoven fabric

is consolidated by high-pressure fluid jets and, at the same time, split into supermicro endless filaments with a titer < 0.2 dtex, and subsequently impregnated with a polymer. The products obtained in this way are very uniform with regard to their strength, because the filament distribution in the product is isotropic, to a great extent. The products do not demonstrate any tendency towards delamination and demonstrate high modulus values as well as tear resistance and tear propagation resistance values.

Another advantageous further development of the process includes the step that consolidation and splitting of the multi-component endless filaments takes place in that the pre-consolidated nonwoven fabric is alternately impacted from both sides with high-pressure water jets, several times. This method of consolidation and splitting the multi-component endless filaments results in very dense nonwoven fabrics with smooth surfaces.

Preferably, consolidation and splitting of the multi-component endless filament is carried out on a unit with rotating screen drums. This form of the units permits the construction of very compact systems.

In particularly advantageous manner, impregnation of the nonwoven fabric, which has been predominantly split into supermicro endless filaments and consolidated, is carried out with an aqueous polyurethane or NBR latex dispersion. In this way, residues of solvent are avoided, and impregnation with the polymer is carried out in particularly environmentally friendly manner.

In preferred manner, the impregnated material is still subjected to subsequent treatment by grinding or buffing. With these measures, the surface consistency and the feel of the material obtained can be further improved. Because of the microfilaments contained in the structure, this results in a



A nonwoven fabric layer with a surface weight of approximately 160 g/m<sup>2</sup> is produced from a multi-component endless filament made up of 65 wt.-% poly(ethylene terephthalate) and 35 wt.-% poly(hexamethylene adipamide). The starting filaments have a titer of approximately 1.8 dtex and are made up of 16

## Comparison Example

A nonwoven fabric is produced from polyester and polypropylene staple fibers, using intensive needle-punching, and it is impregnated with NBR. Splitting results in a heel lining with a surface weight of 320 g/m<sup>2</sup> and a thickness of 0.85 mm.

A comparison of the strength values and the friction wear resistance is shown in the following Table 1. In this connection, the friction wear resistance was determined in such a way that a sample body with a diameter of 90 mm was clamped into a rotation chuck head and stressed with a scrubbing pressure of 2.8 N/cm<sup>2</sup>. The angle of rotation of the chuck head is 50 degrees. The test sample is tested against a scrubbing element that has a diamond pattern on its surface. The measurement sample is wetted with water and put into cyclic back-and-forth motion, where a scrubbing cycle is composed of 300 back-and-forth movements, followed by a visual assessment using a grading sample.

		Example	Comparison Example
Weight	g/m <sup>2</sup>	260	320
Thickness	mm	0.75	0.85
Surface	Grade	1.0	1.0
10% modulus lengthwise	N / 5 cm	220	310
10% modulus crosswise	N / 5 cm	160	85
Tear propagation resistance lengthwise	N	21	10
Tear propagation resistance crosswise	N	21	10
Friction wear (according to WN 3147/1)	Grade	1.0	1.0-1.5

Table 1

What is claimed is:

1. A heel lining for the shoe industry, made up of a nonwoven fabric impregnated with a polymer, having a surface weight of 180 to 350 g/m<sup>2</sup>, and tear propagation resistance values > 15 N in both the lengthwise and the crosswise direction, where the nonwoven fabric being made up of melt-spun, multi-component endless filaments, aerodynamically stretched and directly laid up to form a nonwoven material, having a titer < 2 dtex, and the multi-component endless filaments, after preliminary bonding, are split and bonded up to at least 90 % to produce supermicro endless filaments having a titer < 0.2 dtex.
2. The heel lining according to Claim 1, wherein the multi-component endless filament is a bi-component endless filament of two incompatible polymers, particularly a polyester and a polyamide.
3. The heel lining according to Claim 2, wherein the polyester proportion of the multi-component endless filament is higher than the polyamide proportion.
4. The heel lining according to Claim 3, wherein the weight ratio of the polyester proportion to the polyamide proportion in the multi-component endless filament is 1.1:1 to 3:1.
5. The heel lining according to one of Claims 1 to 4, wherein the multi-component endless filaments have a cross-section with an orange-like multi-segment structure, where the segments alternately containing one of the two incompatible polymers, in each instance.
6. The heel lining according to one of Claims 1 to 5, wherein the nonwoven fabric made of the multi-component

endless filaments is pre-calandered for the purpose of preliminary prebonding.

7. The heel lining according to one of Claims 1 to 6, wherein at least one of the incompatible polymers that forms the multi-component endless filament contains an additive, such as dyeing pigments, permanently acting anti-statics and/or additives that influence the hydrophilic properties, in amounts up to 15 wt.-%.
8. The heel lining according to one of Claims 1 to 7, wherein the multi-component endless filament is not crimped.
9. The heel lining according to one of Claims 1 to 8, wherein the nonwoven fabric is impregnated with 20 to 50 wt.-% of a polymer, with reference to the starting weight of the nonwoven fabric.
10. The heel lining according to one of Claims 1 to 9, wherein a high-quality nubuck-like surface is formed after polishing, brought about by the microfilament ends exposed at the surface.
11. The heel lining according to one of Claims 1 to 10, wherein one of the two sides is provided with an application of hot-melt glue.
12. A method for the production of a heel lining according to one of Claims 1 to 11, characterized in that multi-component endless filaments are spun from the melt, aerodynamically stretched, and directly laid up to form a nonwoven material; a prebonding takes place by calendering or needle-punching; and the nonwoven fabric is bonded by high-pressure fluid jets and, at the same time, split into supermicro-filaments having a titer < 0.2 dtex, and subsequently impregnation with a polymer

takes place.

13. The process according to Claim 12, wherein bonding and splitting of the multi-component endless filaments takes place in that the pre-bonded nonwoven fabric is alternately impacted from both sides with high-pressure water jets, several times.
14. The process according to Claim 13, wherein bonding and splitting of the multi-component endless filament is carried out on a unit with rotating screen drums.
15. The process according to one of Claims 12 to 14, wherein impregnation is carried out with an aqueous polyurethane latex dispersion.
16. The process according to one of Claims 12 to 15, wherein subsequent treatment by polishing or buffing is carried out.

## Abstract

The invention relates to a heel lining for the shoe industry, in which the material is a nonwoven fabric impregnated with a polymer, with a surface weight of 180 to 350 g/m<sup>2</sup>, and tear propagation resistance values > 15 N in both the lengthwise and the crosswise direction, where the nonwoven fabric is made up of melt-spun, aerodynamically stretched multi-component endless filaments, with a titer < 2 dtex, immediately deposited to form a nonwoven layer, and the multi-component endless filaments, after preliminary bonding, are split by at least 90% to produce supermicro endless filaments with a titer < 0.2 dtex, and bonded.

HEEL LINING FOR THE SHOE INDUSTRY

Field of the Invention

The present invention relates to a heel lining for a shoe, and to a method for the production of a heel lining.

5 Background of the Invention

In the shoe industry, particularly wear-resistant materials are used for lining the back part of a shoe, the so-called heel cap. These materials are supposed to absorb the forces that are exerted on the shoe by the foot, particularly during the flexing movement,  
10 in the longitudinal direction, for one thing, and for another, they must be able to withstand the friction forces that are caused in the shoe while walking, since the foot moves at least partially up and down within it. In order to prevent the foot from unintentionally slipping out of the shoe, a material similar to  
15 rough leather or suede is traditionally used as a heel lining, which prevents the foot from slipping out of the shoe by the effect of the friction between the lining and the foot or the lining and the wearer's sock or stocking.

20 In addition to heel linings made from natural materials, synthetic materials are also used. These synthetic materials are typically needle-punched nonwoven fabrics that are produced using the dry method, by crimping, and made of polyester, viscose, polyamide, or polypropylene fibers, or of mixtures of these fibers. For this  
25 purpose, fiber layers with a surface weight of up to 800 g/m<sup>2</sup> are laid down and mechanically consolidated by intensive needle-punching. This process step alone is very time-consuming and therefore relatively cost-intensive. It is generally followed by shrinkage of the needle-punched nonwoven fabric by hot air or



steam, resulting in compaction of the material as well as further consolidation with regard to adjustment of the density desired for the purpose of use. In order to achieve the necessary strength parameters such as tear resistance and tear propagation resistance of the needle-punched nonwoven fabric, the latter is impregnated with a latex binder dispersion that coagulates under the effect of heat, such as styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) and subsequently dried. The latex proportion is about 30 to 60 wt.-% of the weight of the impregnated nonwoven fabric. The material prepared in this way is split into two to four thinner layers. This splitting process was taken over for nonwoven fabrics from the leather industry, in order to increase the productivity of nonwoven fabric production. The split products can be ground in order to make the surface uniform, or in order to improve the optical finish. Subsequently, a hot-melt glue is applied to one of the two sides, in order to simplify further processing. Some of the disadvantages of the synthetic heel linings used until now have been, for example, the very different strength values in the lengthwise and the crosswise direction, the loss in strength which occurs by splitting the fiber bundles that are arranged vertically as a result of needle-punching, and the lack of uniformity of the individual layers, caused by the position of the layers relative to the needle entry and exit side.

#### Description of the Present Invention

The present invention, in accordance with one embodiment, provides a heel lining for the shoe industry that demonstrates tear resistance and tear propagation resistance values  $> 15$  N in both the lengthwise and the crosswise direction, at surface weights of 180 to 350 g/m<sup>2</sup>.

The present invention also provides a particularly suitable process for the production of such a heel lining.

This task is accomplished, according to an exemplary embodiment of the present invention, by a heel lining that is made up of a nonwoven fabric impregnated with a polymer, with a surface weight of 180 to 350 g/m<sup>2</sup>, and tear propagation resistance values > 15 N in both the lengthwise and the crosswise direction, where the nonwoven fabric is made up of melt-spun, aerodynamically stretched multi-component endless filaments, with a titer < 2 dtex, immediately deposited to form a nonwoven layer, and the multi-component endless filaments, after preliminary consolidation, are split by at least 90% to produce supermicro endless filaments with a titer < 0.2 dtex, and consolidated. These heel linings demonstrate high tensile strength and friction wear resistance values at low surface weight.

Preferably, the heel lining is one in which the multi-component endless filament is a bicomponent endless filament of two incompatible polymers, particularly a polyester and a polyamide. As a result, the multi-component endless filament demonstrates good splittability and a very advantageous ratio of strength to surface weight.

Preferably, the heel lining is one in which the polyester portion of the multi-component endless filament is higher than the polyamide portion, particularly in the range of a weight ratio of the polyester portion to the polyamide portion of 1.1:3 to 3:1. As a result, the heel linings demonstrate a very textile feel and good resistance to aging.

A heel lining in which the multi-component endless filaments have a cross-section with an orange-like multi-segment structure is particularly preferred, where the segments alternately contain one of the two incompatible polymers.

Preferably, the heel lining is one in which the nonwoven fabric

made of the multi-component endless filaments is pre-calandered for the purpose of preliminary consolidation. This causes the material to demonstrate very good uniformity in thickness.

5 Furthermore, a heel lining in which at least one of the incompatible polymers that forms the multi-component endless filament contains an additive, such as color pigments, permanently acting anti-statics and/or additives that influence the hydrophilic or hydrophobic properties, in amounts up to 15 wt.-%,  
10 is particularly preferred. In this way, the heel lining can be positively influenced with regard to its resistance to fading, its tendency to become electrostatically charged, the transport of perspiration, or the effect of accumulated moisture. Furthermore, the addition of color pigments into the spinning mass makes it  
15 possible to produce dark colors, resistant to friction wear.

Furthermore, a heel lining in which the multi-component endless filament is not crimped is particularly preferred, since this ensures the textile feel that results from the good splittability  
20 into supermicro endless filaments.

A heel lining in which the nonwoven fabric is impregnated with 20 to 50 wt.-% of a polymer, with reference to the starting weight of the nonwoven fabric, is particularly preferred according to the  
25 invention. At comparable degrees of impregnation, the heel lining demonstrates superior strength properties as compared with the known synthetic heel lining materials.

It is advantageous if the heel lining is one in which one of the  
30 two sides is provided with an application of hot-melt glue. Such a material is particularly well suited for further processing on automatic machines.

The process according to the present invention, for the production

of the heel lining, includes the steps that multi-component  
 endless filaments are spun from the melt, aerodynamically  
 stretched, and immediately deposited to form a nonwoven layer,  
 that preliminary consolidation takes place by needle-punching or  
 5 calandering, and that the nonwoven fabric is consolidated by high-  
 pressure fluid jets and, at the same time, split into supermicro  
 endless filaments with a titer  $< 0.2$  dtex, and subsequently  
 impregnated with a polymer. The products obtained in this way are  
 very uniform with regard to their strength, because the filament  
 10 distribution in the product is isotropic, to a great extent. The  
 products do not demonstrate any tendency towards delamination and  
 demonstrate high modulus values as well as tear resistance and  
 tear propagation resistance values.

15 Another advantageous further development of the process includes  
 the step that consolidation and splitting of the multi-component  
 endless filaments takes place in that the pre-consolidated  
 nonwoven fabric is alternately impacted from both sides with high-  
 pressure water jets, several times. This method of consolidation  
 20 and splitting the multi-component endless filaments results in  
 very dense nonwoven fabrics with smooth surfaces.

Preferably, consolidation and splitting of the multi-component  
 endless filament is carried out on a unit with rotating screen  
 25 drums. This form of the units permits the construction of very  
 compact systems.

In particularly advantageous manner, impregnation of the nonwoven  
 fabric, which has been predominantly split into supermicro endless  
 30 filaments and consolidated, is carried out with an aqueous  
 polyurethane or NBR latex dispersion. In this way, residues of  
 solvent are avoided, and impregnation with the polymer is carried  
 out in particularly environmentally friendly manner.

In preferred manner, the impregnated material is still subjected to subsequent treatment by grinding or buffing. With these measures, the surface consistency and the feel of the material obtained can be further improved. Because of the microfilaments contained in the structure, this results in a particularly good and high-quality, nubuck-like surface, which is very similar to that of natural leather.

#### Example

A nonwoven fabric layer with a surface weight of approximately 160 g/m<sup>2</sup> is produced from a multi-component endless filament made up of 65 wt.-% poly(ethylene terephthalate) and 35 wt.-% poly(hexamethylene adipamide). The starting filaments have a titer of approximately 1.8 dtex and are made up of 16 segments, where polyester and polyamide segments alternate around a center axis, like orange wedges. The melt-spun multi-component endless filaments are aerodynamically stretched and deposited on a belt in random order. The nonwoven fabric layer obtained in this way is passed to a pre-calendering step at a temperature of approximately 95 °C and a pressure of approximately 100 bar. After mechanical pre-consolidation using needle-punching, water-jet treatment at a water pressure of approximately 100 bar takes place. Subsequently, splitting of the multi-component endless filaments into supermicro endless filaments with a titer of approximately 0.1 dtex and consolidation of the nonwoven fabric, using high-pressure water jets, take place. The treatment takes place twice from both sides, in each instance, at water pressures of 250 and 300 bar, and on screen bases with a mesh width of 60 to 100 mesh. The nonwoven fabric is subsequently dried and subjected to impregnation with polymer, using a wet-in-dry treatment with NBR latex. Approximately 125 wt.-% NBR are applied, with reference to the starting weight of the nonwoven fabric, and are fixed by drying at 180 °C. After grinding, a heel lining with a weight of 260 g/m<sup>2</sup> and a thickness of 0.75 mm is obtained.

Comparison Example

A nonwoven fabric is produced from polyester and polypropylene staple fibers, using intensive needle-punching, and it is impregnated with NBR. Splitting results in a heel lining with a surface weight of 320 g/m<sup>2</sup> and a thickness of 0.85 mm.

A comparison of the strength values and the friction wear resistance is shown in the following Table 1. In this connection, the friction wear resistance was determined in such a way that a sample body with a diameter of 90 mm was clamped into a rotation chuck head and stressed with a scrubbing pressure of 2.8 N/cm<sup>2</sup>. The angle of rotation of the chuck head is 50 degrees. The test sample is tested against a scrubbing element that has a diamond pattern on its surface. The measurement sample is wetted with water and put into cyclic back-and-forth motion, where a scrubbing cycle is composed of 300 back-and-forth movements, followed by a visual assessment using a grading sample.

		Example	Comparison Example
Weight	g/m <sup>2</sup>	260	320
Thickness	mm	0.75	0.85
Surface	Grade	1.0	1.0
10% modulus lengthwise	N / 5 cm	220	310
10% modulus crosswise	N / 5 cm	160	85
Tear propagation resistance lengthwise	N	21	10
Tear propagation resistance crosswise	N	21	10
Friction wear (according to WN 3147/1)	Grade	1.0	1.0-1.5

Table 1

Abstract

A heel lining for a shoe, in which the material is a nonwoven fabric impregnated with a polymer, with a surface weight of 180 to 350 g/m<sup>2</sup>, and tear propagation resistance values > 15 N in both the lengthwise and the crosswise direction. The nonwoven fabric is made up of melt-spun, aerodynamically stretched multi-component endless filaments, with a titer < 2 dtex, immediately deposited to form a nonwoven layer. The multi-component endless filaments, after preliminary bonding, are split by at least 90% to produce supermicro endless filaments with a titer < 0.2 dtex, and are bonded.



[22750/543]

## DECLARATION AND POWER OF ATTORNEY

As below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the subject matter that is claimed and for which a patent is sought on the invention entitled **HEEL LINING FOR THE SHOE INDUSTRY**, the specification of which was filed as International Application No. PCT/EP00/08547, on 1 September 2000.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information that is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate filed by me on the same subject matter having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

(Number)	(Country)	(Day/month/year filed)	Priority Claimed Under 35 USC 119
199 47 870.8	Fed. Rep. of Germany	05 October 1999	Yes <u>X</u> No <u>  </u>

And I hereby appoint Richard L. Mayer (Registration No. 22,490) my attorney with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Please address all communications regarding this application to:

KENYON & KENYON



26646

PATENT TRADEMARK OFFICE

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

100

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